



Rocky Mountain Research Station

New Publications

April–June 2023

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Rocky Mountain Research Station

The Rocky Mountain Research Station is one of seven regional units that make up the U.S. Forest Service Research and Development organization.



We maintain 14 research locations throughout a 12-State territory encompassing the Great Basin, Southwest, Rocky Mountains, and parts of the Great Plains. The station employs more than 400 permanent full-time employees, including about 100 research scientists.

Scientists conduct research that spans an area containing 52 percent of the nation's National Forest System lands (54 national forests and grasslands). In the lower 48 States, our territory also includes 55 percent of the nation's Bureau of Land Management lands; 48 percent of the designated wildernesses; 37 percent of National Park Service lands; numerous other public and tribal lands; and 41 percent of the non-urban/rural private lands.

We administer and conduct ecological research on 14 experimental forests, ranges, and watersheds over the long term, even centuries, enabling us to learn how forests change as climate and other factors change over time.

We also oversee activities on several hundred research natural areas, a network of ecosystems set aside to conserve biological diversity. These areas represent a wide variety of habitats and ecosystems from alpine ecosystems to lowlands and from coniferous forests of the Northern Rockies to semiarid deserts of the Southwest and prairie ecosystems of the Great Plains.

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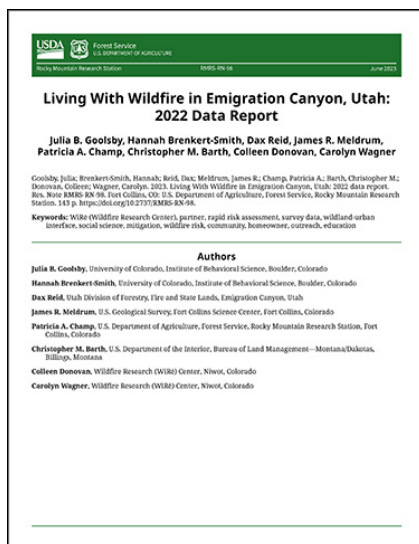


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New RMRS Series Publications

All RMRS Series publications are [available on Treearch](#) at the links below.



RMRS-RN-98: Living With Wildfire in Emigration Canyon, Utah: 2022 Data Report

Goolsby, Julia; Brenkert-Smith, Hannah; Reid, Dax; Meldrum, James R.; Champ, Patricia A.; Barth, Christopher M.; Donovan, Colleen; Wagner, Carolyn. 2023. [Living With Wildfire in Emigration Canyon, Utah: 2022 data report](#). Res. Note RMRS-RN-98. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 143 p. <https://doi.org/10.2737/RMRS-RN-98>.

Located in North Central Utah, Emigration Canyon is a prominent and historic canyon that runs northeast from Salt Lake City into the higher elevations of the Wasatch Mountains. The Wasatch Range is characterized by steep, rocky slopes and 26-44 millimeters of annual rainfall, both of which contribute to a high threat of wildfire. The area's landscape is diverse with oak woodland at the lower elevations up to a conifer forest type including ponderosa pine, Douglas-fir, and subalpine fir. The Utah Wildfire Risk Assessment Portal (UWRAP) rates the fire danger in Emigration Canyon as "Extreme." Resultantly, the Utah Division of Forestry, Fire & State Lands, as well as adjacent land management agencies, have identified this wildland-urban interface (WUI) zone as a high priority. The Utah Division of Forestry, Fire & State Lands website describes WUI as "the zone where structures and other human development meet and intermingle with undeveloped wildland or vegetative fuels."

Keywords: WiRē (Wildfire Research Center); partner; rapid risk assessment; survey data; wildland-urban interface; social science; mitigation; wildfire risk; community; homeowner; outreach; education

Online: <https://www.fs.usda.gov/research/treearch/66201>

Journals and Other Publications

External publications written by RMRS scientists, [available on Treearch](#) and grouped by Science Program Areas. For more information on our Science Program Areas, please visit our web site: www.fs.usda.gov/research/rmrs/programs.

Fire, Fuel and Smoke

Keane, Robert E.; Schoettle, Anna W.; Tomback, Diana F. 2022. [Effective actions for managing resilient high elevation five-needle white pine forests in western North America at multiple scales under changing climates](#). Forest Ecology and Management. 505: 119939.

Forest and Woodland Ecosystems

Bentz, Barbara J.; Millar, Constance I.; Vandygriff, James C.; Hansen, Earl M. 2022. [Great Basin bristlecone pine mortality: Causal factors and management implications](#). Forest Ecology and Management. 509: 120099.

Burns, Kelly S.; Tinkham, Wade T.; Leddy, K. A.; Schoettle, Anna W.; Jacobi, William R.; Stewart, Jane E. 2023. [Interactions between white pine blister rust, bark beetles, and climate over time indicate vulnerabilities to limber pine health](#). Frontiers in Forests and Global Change. 6: 1149456.

Emick, Ethan; Babcock, Chad; White, Grayson W.; Hudak, Andrew T.; Domke, Grant M.; Finley, Andrew O. 2023. [An approach to estimating forest biomass while quantifying estimate uncertainty and correcting bias in machine learning maps](#). Remote Sensing of Environment. 295: 113678.

Ewane, Ewane Basil; Mohan, Midhun; Bajaj, Shaurya; Galgamuwa, G. A. Pabodha; Watt, Michael S.; Arachchige, Pavithra Pitumpe; Hudak, Andrew T.; Richardson, Gabriella; Ajithkumar, Nivedhitha; Srinivasan, Shruthi; Corte, Ana Paula Dalla; Johnson, Daniel J.; Broadbent, Eben North; de-Miguel, Sergio; Bruscolini, Margherita; Young, Derek J. N.; Shafai, Shahid; Abdullah, Meshal M.; Jaafar, Wan Shafrina Wan Mohd; Doaemo, Willie; Silva, Carlos Alberto; Cardil, Adrian. 2023. [Climate-change-driven droughts and tree mortality: Assessing the potential of UAV-derived early warning metrics](#). Remote Sensing. 15: 2627.

Hoffman, Chad M.; Ziegler, Justin P.; Tinkham, Wade T.; Hiers, John Kevin; Hudak, Andrew T. 2023. [A comparison of four spatial interpolation methods for modeling fine-scale surface fuel load in a mixed conifer forest with complex terrain](#). Fire. 6: 216.

Klimesova, Jitka; Martínková, Jana; Bartuskova, Alena; Ott, Jacqueline P. 2023. [Belowground plant traits and their ecosystem functions along aridity gradients in grasslands](#). Plant And Soil. <https://doi.org/10.1007/s11104-023-05964-1>.

Schoettle, Anna W.; Burns, Kelly S.; McKinney, Shawn T.; Krakowski, Jodie; Waring, Kristen M.; Tomback, Diana F.; Davenport, Marianne. 2022. [Integrating forest health conditions and species adaptive capacities to infer future trajectories of the high elevation five-needle white pines](#). Forest Ecology and Management. 521: 120389.

Human Dimensions

- Belval, Erin J.; Thompson, Matthew P. 2023. [A decision framework for evaluating the Rocky Mountain Area Wildfire Dispatching System in Colorado](#). INFORMS Decision Analysis. <https://doi.org/10.1287/deca.2022.0047>.
- Gannon, Benjamin; Wei, Yu; Belval, Erin; Young, Jesse; Thompson, Matthew; O'Connor, Christopher; Calkin, David; Dunn, Christopher. 2023. [A quantitative analysis of fuel break effectiveness drivers in Southern California National Forests](#). Fire. 6: 104.
- Neukirch, Alexis; Calkin, David; O'Connor, Christopher; Thompson, Matthew; Dunn, Christopher; Caggiano, Michael. 2023. [Embracing PODs: Advancing wildfire response planning](#). International Association of Wildland Fire. Online: <https://www.iaawonline.org/article/embracing-pods-advancing-wildfire-response-planning/>.
- Thompson, Matthew P.; Vogler, Kevin C.; Scott, Joe H.; Miller, Carol. 2022. [Comparing risk-based fuel treatment prioritization with alternative strategies for enhancing protection and resource management objectives](#). Fire Ecology. 18: 26.
- Wei, Yu; Gannon, Benjamin; Young, Jesse; Belval, Erin; Thompson, Matthew; O'Connor, Christopher; Calkin, David. 2023. [Estimating WUI exposure probability to a nearby wildfire](#). Fire Ecology. 19: 30.
- Dumroese, R. Kasten; Zhu, Yan; Acevedo, Manuel A.; Pinto, Jeremiah R.; Alvarez-Maldini, Carolina E.; Liu, Yong. 2023. [Fall fertilization during nursery production increases nitrogen status of *Purshia tridentata* seedlings: Implications for outplanting](#). Restoration Ecology. e13915.
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- Montagnoli, Antonio; Terzaghi, Mattia; Miali, Alessio; Chiatante, Donato; Dumroese, R. Kasten. 2023. [Unusual late-fall wildfire in a pre-Alpine *Fagus sylvatica* forest reduced fine roots in the shallower soil layer and shifted very fine-root growth to deeper soil depth](#). Scientific Reports. 13: 6380.
- Redmond, Miranda D.; Urza, Alexandra K.; Weisberg, Peter J. 2023. [Managing for ecological resilience of pinyon-juniper ecosystems during an era of woodland contraction](#). Ecosphere. 14: e4505.
- Tosevski, Ivo; Sing, Sharlene E.; Caldara, Roberto; Weaver, David K.; Jovic, Jelena; Krstic, Oliver; Hinz, Harriet L. 2023. [Retrospective use of integrative taxonomy in classical biological control: The unintentional introduction of the weevil *Rhinusa dieckmanni* to North America](#). Biological Control. 183: 105270.

Maintaining Resilient Dryland Ecosystems

- Bisbing, Sarah M.; Urza, Alexandra K.; York, Robert A.; Hankin, Lacey E.; Putz, Tessa R. 2023. [Persistent, viable seedbank buffers serotinous bishop pine over a broad fire return interval](#). Fire Ecology. 19: 35.

Vasey, Georgia L.; Urza, Alexandra K.; Chambers, Jeanne C.; Pringle, Elizabeth G.; Weisberg, Peter J. 2023. [Clinal variations in seedling traits and responses to water availability correspond to seed-source environmental gradients in a foundational dryland tree species](#). *Annals of Botany*. <https://doi.org/10.1093/aob/mcad041>.

RMRS-FIA (Forest Inventory, and Analysis)

Dubayah, R. O.; Armston, J.; Healey, S. P.; Yang, Z.; Patterson, P. L.; Saarela, S.; Stahl, G.; Duncanson, L.; Kellner, J. R. 2022. [GEDI L4B Gridded Aboveground Biomass Density, Version 2 \(User guide\)](#). Oak Ridge, TN: ORNL DAAC. <https://doi.org/10.3334/ORNLDAAC/2017>.

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Samuels-Crow, Kimberly E.; Peltier, Drew M. P.; Liu, Yao; Guo, Jessica S.; Welker, Jeffrey M.; Anderegg, William R. L.; Koch, George W.; Schwalm, Christopher; Litvak, Marcy; Shaw, John D.; Ogle, Kiona. 2023. [The importance of monsoon precipitation for foundation tree species across the semiarid Southwestern U.S.](#) *Frontiers in Forests and Global Change*. 6: 1116786.

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Water and Watersheds

Barnard, David M.; Green, Timothy R.; Mankin, Kyle R.; DeJonge, Kendall C.; Rhoades, Charles C.; Kampf, Stephanie K.; Giovando, Jeremy; Wilkins, Mike J.; Mahood, Adam L.; Sears, Megan G.; Comas, Louise H.; Gleason, Sean M.; Zhang, Huihui; Fassnacht, Steven R.; Harmel, R. Daren; Altenhofen, Jon. 2023. [Wildfire and climate change amplify knowledge gaps linking mountain source-water systems and agricultural water supply in the western United States](#). *Agricultural Water Management*. 286: 108377.

Elliot, William J.; Flanagan, Dennis C. 2023. [Estimating WEPP cropland erodibility values from soil properties](#). *Journal of the ASABE*. 66(2): 329-351.

Isaak, Daniel J.; Young, Michael K. 2023. [Cold-water habitats, climate refugia, and their utility for conserving salmonid fishes](#). *Canadian Journal of Fisheries and Aquatic Sciences*. <https://doi.org/10.1139/cjfas-2022-0302>.

Mochnac, Neil J.; Taylor, Mark K.; Docker, Margaret F.; Isaak, Dan J. 2023. [An ectothermal paradox: bull trout populations diverge in response to thermal landscapes across a broad latitudinal gradient](#). Environmental Biology of Fishes. 106: 979-999.

Wilderness (Aldo Leopold Wilderness Research Institute)

Dilts, Thomas E.; Zeller, Katherine A.; Cushman, Samuel A.; Larrucea, Eveline S.; Crowell, Miranda M.; Byer, Nathan W.; Shoemaker, Kevin T.; Matocq, Marjorie D. 2023. [Pygmy rabbit habitat network reveals threats and opportunities for management and conservation](#). Landscape Ecology. <https://doi.org/10.1007/s10980-023-01672-4>.

Kreider, Mark R.; Jaffe, Melissa R.; Berkey, Julia K.; Parks, Sean A.; Larson, Andrew J. 2023. [The scientific value of fire in wilderness](#). Fire Ecology. 19: 36.

Parks, Sean A.; Holsinger, Lisa M.; Blankenship, Kori; Dillon, Gregory K.; Goeking, Sara A.; Swaty, Randy. 2023. [Contemporary wildfires are more severe compared to the historical reference period in western US dry conifer forests](#). Forest Ecology and Management. 544: 121232.

Wultsch, Claudia; Zeller, Katherine A.; Welfelt, Lindsay S.; Beausoleil, Richard A. 2023. [Genetic diversity, gene flow, and source-sink dynamics of cougars in the Pacific Northwest](#). Conservation Genetics. <https://doi.org/10.1007/s10592-023-01532-3>.

Wildlife Ecology

Chmura, Helen E.; Duncan, Cassandra; Burrell, Grace; Barnes, Brian M.; Buck, C. Loren; Williams, Cory T. 2023. [Climate change is altering the physiology and phenology of an arctic hibernator](#). Science. 380: 846-849.

Pilgrim, Kristine L.; Green, Rebecca E.; Purcell, Kathryn L.; Wilcox, Taylor M.; McGregor, Eric L.; Gleason, Larissa E.; Wasser, Samuel K.; Schwartz, Michael K. 2023. [Shifts in fisher \(*Pekania pennanti*\) diet in response to climate-induced tree mortality in California assessed with DNA metabarcoding](#). Journal for Nature Conservation. 73: 126408.

Reynolds-Hogland, Melissa; Ramsey, Alan B.; Muench, Carly; Terkildsen, Kirsten; Pilgrim, Kristine L.; Engkjer, Cory; Ramsey, Philip W. 2023. [Video-documentation of true and borderline tool use by wild American black bears](#). Ursus. 34: e3.

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